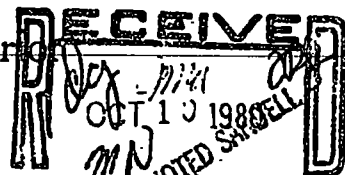




United States Department of the Interior

GEOLOGICAL SURVEY

Conservation Division
Area Oil Shale Supervisor's Office
Mesa Federal Savings & Loan
131 N. 6th, Suite 300
Grand Junction, Colorado 81501



U.S. GEOLOGICAL SURVEY
ALBUQUERQUE, NEW MEXICO

October 7, 1980

Memorandum

Confidential Claim Retracted

To: Ed Sandell, Acting DCM Mining
South Central Region

Authorized by: SC

Through: Area Oil Shale Supervisor *MBR*

Date: 4/24/13

From: Dave Oberwager, Environmental Scientist

Subject: Reclamation program for Anaconda Uranium Mine

In order to confirm some of the items we discussed concerning the reclamation program for the Anaconda Uranium Mine on the Laguna Indian lands, the following items came to mind.

The grass and shrub species being used for the revegetation program are compatible and acceptable. This was well demonstrated on the one area that we visited that had been in production for approximately 6 years. I feel that the methods used in this area for reclamation and revegetation can be acceptable for other areas to be reclaimed. I would suggest though, that a chemical analysis be made of the soils, vegetation, and water in the area and compared to a similar vegetation type in the immediate mine vicinity in order to compare natural water, soil, and plant chemistry. Tests should be made for both micro and macronutrients, trace elements, and possible toxic compounds. All seedings should be inoculated and treated as we discussed at the mine.

Plant species, density, and composition in the revegetation area appeared equal to some of the surrounding undisturbed areas. I would suggest a vegetative monitoring program yearly report be made available to your office in order to be assured of revegetation progress or lack of it.

As an alternative reclamation program that might be presented to the Tribal Council and not be more costly to the Anaconda people would be a more intensive type of agriculture. The large relatively flat areas both in the pit and on the spoil piles might be used for hay, grain, or pasture for a more intensive livestock operation or cash crop.



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Water for irrigation from the existing wells or irrigation reservoirs developed as part of the reclamation earth-moving program during pit filling could easily be developed. This intensive agriculture program could significantly help from a socioeconomic standpoint partially balancing the income loss due to closing of the mine. Also intensive agricultural operation would contain much of the annual precipitation and reduce erosion. The intensified agricultural program could also possibly improve the deer habitat which, if properly managed, could be another income source, as well as food. Guiding hunters from the Albuquerque area is an example.

I feel the agronomic phase of this operation will not be extremely difficult to accomplish. The engineering phase which must first be carried out has a number of features that must be separately addressed. I feel that if rock mechanics tests prove adequate stability of the sandstone high walls, they should be left as is. They would be aesthetically compatible with the surrounding area now having vertical walls and escarpments. They would also contribute to a raptor habitat development.

The Mancos shale walls in the pit area should be reduced to manageable non-erodible slopes, that can be covered with a plant growth medium and revegetated. Erosion control of man-made slopes usually requires a 3:1 or flatter grade with relatively short scopes or run (achieved by benching).

Existing spoil piles that have steep slopes, that are now unstable as indicated by little or no vegetative growth (except some annual weeds), rilling and gullyng of slopes and talus accumulation at toe of piles must be stabilized.

This can be accomplished in a number of ways:

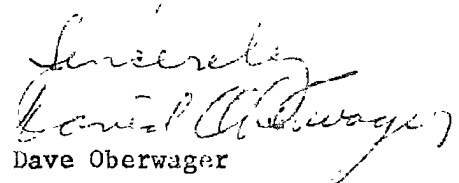
1. Dikes and diversions on top of piles to divert and contain precipitation and high intensity storms.
2. Flat non-erodible slopes 4:1 acceptable, 3:1 sometimes workable, but questionable.
3. Combination of workable slopes and reverse grade terraces to shorten the scope or run.

4. Large rock mulching of slopes to create many microenvironments that will slowly revegetate.
5. Grass and hay mulching of seeded areas.
6. Seed annual rye or barley into freshly prepared seed bed for quick establishment of cover. This creates an acceptable atmosphere for later seeding of permanent mixture. It adds organic matter to soil, and the standing stubble gives protection to new seedlings.

I also feel that intensive testing of all aquifers are needed to ensure safety and health of people and livestock that will be using the area for grazing or drinking purposes.

After establishment of vegetative cover is achieved, a good management program must be established for continued vegetative success. This would include a grazing program, on range or irrigated pasture, or harvesting program for hay or grain.

Sorry we did not have more time to review and evaluate the plan and mine operation. If you have need of further help, call and I will try to give any assistance I can.

Sincerely,

Dave Oberwager